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Original Article

# Diabetic striatopathy—Does it exist in non-Asian subjects?

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ABSTRACT

*Background:* Diabetic striatopathy (DS) is a rare complication of diabetes mellitus (DM). The syndrome appears in patients with uncontrolled DM and is characterized by abrupt onset of movement disorder, mainly hemichorea and accompanied by specific findings on brain imaging. It is believed that DS is unique to the Asian population and affects mainly elderly women with uncontrolled DM.
*Methods:* In order to define existence and characterization of DS in Western population, we reviewed the medical records of all patients admitted to the Chaim Sheba Medical Center between 2004 and 2014 and identified those with documented elevated HbA1c (>10%). The charts and imaging studies of those with elevated HbA1c and undiagnosed neurological symptoms were reviewed to diagnose DS.
*Results:* Out of 697 patients with HbA1c > 10%, 328 patients had unknown neurological diagnosis. Among them, we identified 4 patients (3 women, mean age 73 and mean HbA1c of 14.8%) with hemichorea or choreoathetosis and brain imaging findings compatible with the diagnosis of DS. Only one out of the 4 patients was diagnosed during hospitalization with DS. All patients were treated with insulin with improvement of their symptoms during hospitalization. However, there was a recurrence in 2 of them and 1 died during the second episode.
*Conclusion:* Diabetic striatopathy exists but underdiagnosed in the Western population. It is important to increase the awareness for this clinical syndrome in order to treat those patients properly.


## 1. Introduction

Diabetic striatopathy (DS), also known as "chorea, hyperglycemia, basal ganglia syndrome" [1] or "hemi-chorea nonketotic hyperglycemia syndrome" [2] is a rare manifestation of diabetes mellitus (DM).

The typical patient is an Asian elderly woman with poorly controlled DM (i.e. elevated hemoglobin A1c [HbA1c] levels), which presents with acute onset of hemichorea. Distinctive brain imaging of hyperintensities in the basal ganglia helps to establish the diagnosis [3]. Moreover, it has been stated that up to 90% of the cases reported so far occurred in Asian population [1].

While the incidence of type 2 DM in the Western world is rising, the knowledge regarding this specific complication in the Western population is limited.

The aim of this study was to identify, in a large tertiary center, patients with DS in a Western population and to describe the incidence, clinical presentation, and imaging characteristics of this syndrome.

## 2. Patients and methods

We conducted a retrospective study using the electronic medical records of the "Chaim Sheba Medical Center," a tertiary medical center, and the largest medical center in Israel. We searched the database for all patients older than 18 years who were admitted for any cause between January 2004 and December 2014 and who had a diagnosis of DM and had levels of HbA1c measured during hospitalization. We identified those with extremely uncontrolled DM, defined by HbA1c level of 10%, or higher. We then reviewed the records of those who had admission or discharge diagnosis of any neurological disorder, hyperglycemia, unknown diagnosis, or a missing diagnosis (Suppl 1). Patients with a clear diagnosis of cerebrovascular accident and no other diagnosis from the list were excluded. For the rest, we checked if the clinical presentation could be related to DS. Those with sudden onset of hemichorea or hemiballismus, uncontrolled DM, and available brain imaging were assessed by neuro-radiologist to make the diagnosis.

Increased density within the basal ganglia on computed tomography (CT) scan or T1 shortening on magnetic resonance imaging (MRI) were considered as confirmatory radiological findings.

Each suspected case was then reviewed by two internal medicine specialist (EG and AL) and an expert in neuroradiology (GG) to confirm the diagnosis of DS.

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## 3. Results

We identified 697 patients older than 18 years admitted between January 2004 and December 2014, with HbA1C ≥ 10%. Out of this group, 328 patients were admitted or discharged with a diagnosis of movement disorder, chorea, or any non-specific or other neurological disorder.

After a careful evaluation, 4 Caucasian patients (3 females, mean age 73 years) were definitely diagnosed with DS. All four subjects were diagnosed with type 2 DM before the admission, and were treated with insulin (Table 1).

In all patients, newly onset neurological symptoms were present upon admission—three subjects presented with hemichorea (either left or right side) and one with left-sided choreoathetosis (Table 1).

Laboratory studies upon admission showed poor glycemic control in all 4 subjects, with a mean HbA1c of 14.8 ± 1.8%, and mean serum glucose level of 300 ± 81 mg/dL. Urine analysis was positive for ketones in one subject and negative in one subject; no data were recorded for the other two subjects.

All patients had increased density within the contralateral basal ganglia (Table 2). One patient had increased T1 signal intensity in the right basal ganglia in an MRI study corresponding to the changes seen on CT (Fig. 1). Two patients had follow-up CT scans after the resolution of the clinical syndrome showing normalization of the study with normal gray matter density.

Region-of-interest (ROI) measurements of the basal ganglia lesions were in the range of 38–40 Hounsfield Units (HU).

In two patients, the diagnosis of DS was suspected during hospitalization but only one was treated accordingly.

All patients were treated with insulin per protocol, according to repeated glucose measures, as accepted in the Chaim Sheba medical center. Three patients were also treated with neuroleptic drugs—haloperidol, zuclopenthixol, and risperidone. All patients showed at first some clinical improvement in their choreiform movements and were discharged from the hospital for ambulatory treatment.

Recurrence was reported in two out of the 4 patients, one patient stayed free of symptoms through more than a year of follow-up and one was lost to follow-up. One of the patients was readmitted 3 months after the first admission due to worsening of the chorea and bilaterllization of the symptoms. At the second admission, though recognized correctly and treated with insulin and anti-psychotics, she died of respiratory failure.

**Table 2**
Imaging findings of our patients during hospitalization.

| Case | Imaging | CT ROI measurements |
|---|---|---|
| 1 | CT 2/2014 Increased density within the left basal ganglia, both lentiform and caudate nuclei. Generalized brain atrophy and chronic ischemic changes including old lacunar infarcts. CT 5.2014 bilateral hyperdensity in both basal ganglia which has progressed from prior study. | ROI measurements provide values of 40 HU less than the range of hemorrhages |
| 2 | CT 10.2014 Increased density within the left basal ganglia including lentiform and caudate nuclei. There is mild mass effect on the left ventricle. Otherwise, there is generalized brain atrophy with chronic ischemic changes in the white matter including lacunar infarcts/ a possible cavernoma in the left frontal lobe (not shown). | ROI measurements of the BG are in the range of 38 HU. |
| 3 | CT 1.2011 Increased density within the right basal ganglia including both lentiform and caudate nuclei. Mild mass effect on the right frontal horn. There is an old lacunar infarct in the left lentiform nucleus. MRI scans on Nov. 2011 revealed increased T1 signal intensity in the right basal ganglia corresponding to the changes seen on CT. A follow-up scan on 2013 showed complete resorption of the phenomenon. GRE studies (not shown) demonstrated physiologic mineralization within the globus pallidus not directly associated with the T1 shortening. | ROI measurement is in the range of 40 HU |
| 4 | CT 12.2011 Increased density within the right basal ganglia including lentiform and caudate nuclei. For comparison a scan performed a few months earlier depicts normal gray matter density | |

ROI = region of interest. HU = Hounsfield units.

## 4. Discussion

In this study, we described the characteristics of DS in the Western population. We identified 4 patients with definite diagnosis of DS out of 697 patients who were hospitalized for any cause and had extremely uncontrolled type 2 DM. Among patients with extremely uncontrolled type 2 DM who were hospitalized for neurological symptoms, 1.2% had DS. We believe that more patients had this syndrome, but since we were very strict with our criteria, we included only those with definite diagnosis based on clinical, laboratory, and imaging findings. We did not review the charts of patients with HBA1C levels <10% because the likelihood of this syndrome in these patients is low, but we cannot exclude the possibility that we missed some patients with this syndrome who had HBA1C < 10%. We also did not review the charts of patients who did not have records of HBA1C levels during hospitalization and therefore could have missed more patients with this syndrome. In two patients, the syndrome was not diagnosed during hospitalization

**Table 1**
Clinical and laboratory parameters at presentation and outcome.

| Case | Age (Y) | Gender | Presentation[a] | Diabetic treatment[a] | HbA1C (%) | Glucose (mg/dL)[b] | Urine ketones[b] | Comorbidities | Recurrence | Outcome |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 82 | F | Hemichorea of right arm and leg, mostly arm | Insulin glargine 30 U/day insulin aspart 10 U 3 times/day | 17.4 | 199 | Negative | Paroxysmal atrial fibrillation diastolic heart failure recurrent CVAs s/p aortic valve replacement depressive disorder | Yes | Exitus |
| 2 | 81 | M | Hemichorea of right arm and leg | Insulin glargine[#] metformin 850 mg twice daily | 14 | 276 | Missing | Ischemic heart disease hypertension s/p CVA Heavy smoker | Yes | Discharge |
| 3 | 49 | F | Hemichorea of left arm and leg | Insulin detemir 30 U/day metformin 850 mg once daily | 13.2 | 340 | Positive | Hypertension depressive disorder migraines | No | Discharge |
| 4 | 80 | F | Choreoathetosis of left hand | Insulin glargine[c] | 14.7 | 387 | Missing | Hypertension s/p carcinoma of breast | Unknown | Discharge |

Y = years, F = female, M = male, CVA = cerebrovascular accident, S/P = status post.
[a] As described in the admission report.
[b] Upon admission.
[c] No record of exact dose.

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